# Mobile Unit for Underground Distribution System Work

Hydro-Québec Distribution operates some 2,000 underground vaults on the Île de Montréal. The Institut de recherche d'Hydro-Québec (IREQ) is conducting research on ways to maintain the reliability and efficient management of the distribution system while ensuring worker safety. Its researchers have developed a robotized mobile unit for underground work. This robot brings Hydro-Québec's work methods up to date and helps improve the system average interruption duration index.

## *Robot arm and manipulator*

The robotic system on the mobile work unit is composed of a hydraulic arm with an electric manipulator. It also includes special tools for performing robotized work on power system equipment. The first step in an underground job consists in positioning the vehicle beside the underground vault and setting up the work area. From the command station, the operator manoeuvers the hydraulic arm into the vault and positions its end near the switch. At the end of the arm is the electric manipulator, whose role is to perform tasks on the switch with the appropriate tools. The operator orders the tasks and supervises the operation.

## *Worker safety*

The mobile work unit is a vehicle that can travel on roads and climb onto sidewalks, and has a robotized system that can perform operations remotely in underground distribution vaults. The operator can thus perform work on equipment from the command station in the vehicle. This greatly improves the safety of workers, since they can carry out jobs in any underground vault while remaining outside it, regardless of access restrictions. By using robotized means to perform repetitive tasks, the unit also improves work methods.

### *Main advantages*

The mobile work unit can perform the main jobs required on system switches, namely:

- locating the switch with a laser beam
- inspecting the switch and checking the condition of the electrical contacts through the look-hole
- performing an action on the switch lever
- checking for voltage on line phases
- locking out the switch

### *Caractéristiques*

| | |
|---|---|
| **Vehicule** | |
| Model | Holder C2.42 |
| **Robot arm** | |
| Degrees of freedom | 5 |
| Range | 4 m |
| Mass | 250 kg |
| Useful load | 115 kg |
| Motor | Hydraulic and electric |
| **Manipulator** | |
| Degrees of freedom | 6 |
| Range | 1.25 m |
| Mass | 70 kg |
| Useful load | 5 kg (continuous) |
| | 25 kg (5 seconds during operation) |
| Material | Machined parts, 6061-T6 aluminum and titanium |
| Motor | Electric motors at 6 axes |
| Brakes (active when de-energized) | Magnetic at axes 1, 2 and 3 |
| ➤ Positioning | Electric absolute encoders at 6 axes |
| ➤ Power and control electronics | Built into the parts |
| ➤ Articulation range and speed of movement | Axis 1 : 225°, 12.5 RPM |
| | Axis 2 : 115°, 12.5 RPM |
| | Axis 3 (linear): 550 mm, 200 mm/s |
| | Axis 4 : 380°, 13.5 RPM |
| | Axis 5 : 165°, 20 RPM |
| | Axis 6 : 380°, 12.50 RPM |
| ➤ Instrumentation | Load cell |
| | Tool changer |
| | Camera |

### *For information*

Stéphane Reiher, Project Coordinator
Institut de recherche d'Hydro-Québec
1800, boul. Lionel-Boulet
Varennes (Québec) J3X 1S1
Canada
Telephone: 450 652-8449
E-Mail: reiher.stephane@ireq.ca

**March 2012**

2012G069_UnitéMobile_A

Hydro Québec